



LSA-2050

LEAF-STATE-ANALYZER

The LEAF-STATE-ANALYZER LSA-2050 is a handheld device for non-invasive leaf analysis. The device analyses three areas that are related to the state of health of the plant: (1) the extent of protection from ultraviolet and strong visible radiation, (2) the chlorophyll concentration, and (3) the maximum photochemical quantum yield of photosystem II, F_V/F_M . In summary, the LEAF-STATE-ANALYZER LSA-2050 provides a picture of stress effects and a plant's ability to cope with stress.

Outstanding Properties of the LEAF-STATE-ANALYZER

- Measures protection against the particularly harmful UV-B radiation
- Probes screening at four wavebands: UV-B, UV-A, blue, and green
- Provides the stress factors chlorophyll content and photosystem II damage

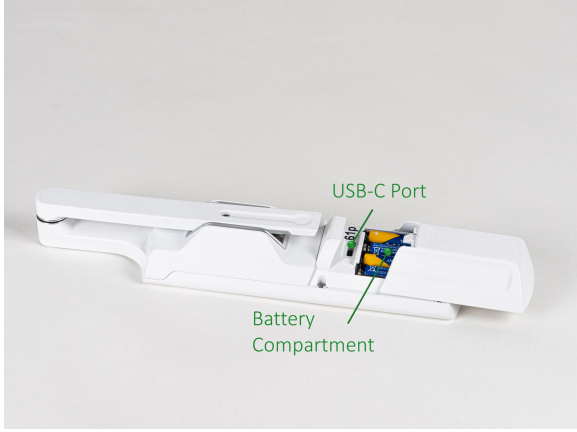
LEAF-STATE-ANALYZER



Probing a leaf after predarkening in a Darkening Bag (LSA-2050/DB). Dark acclimation is important for correct determination of the maximum Photosystem II yield, F_v/F_M .



Functional units of the LEAF-STATE-ANALYZER LSA-2050. "Emitter Detector Head": LEDs and detector for screening and F_v/F_M measurements. "FR, NIR Emitter": LEDs for determination of chlorophyll concentration.



Battery compartment and USB-C port for data transfer.



LEAF-STATE-ANALYZER LSA-2050 with lower part removed for fruit measurements.

General Features LEAF-STATE-ANALYZER

The LEAF-STATE-ANALYZER LSA-2050 measures radiation screening by the efficiency of fluorescence excitation. The four different excitation wavebands used can be assigned to four pigment groups: UV-B and UV-A to hydroxycinnamic acids and flavonoids, respectively [1], blue to carotenoids [2], and green to anthocyanins [3]. Absorbance values indicating relative flavonoid and anthocyanin concentration are provided.

Chlorophyll concentration is measured by the Cerovic method [4]. The method excels by high response even at high chlorophyll concentrations. Photosystem II is analyzed by the well-proven PAM fluorescence/saturation pulse method [5]. With each measurement, GPS data, leaf orientation, and the direction of sun radiation are logged.

[1] Bilger W, Veit M, Schreiber L, Schreiber U (1997) Measurement of leaf epidermal transmission of UV radiation by chlorophyll fluorescence. *Physiol Plant* 101: 754-763

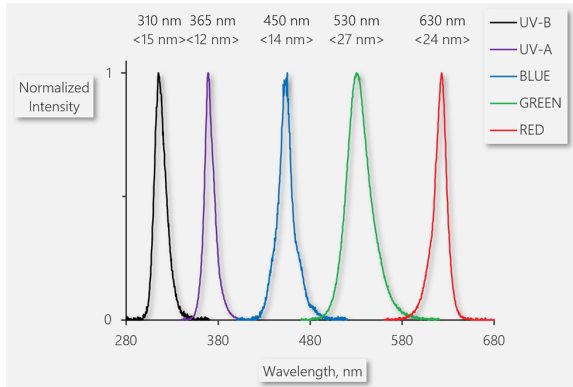
[2] Nichelmann L, Schulze M, Herppich WB, Bilger W (2016) A simple indicator for non-destructive estimation of the violaxanthin cycle pigment content in leaves. *Photosynth Res* 128: 183-193

[3] Cerovic ZG, Moise N, Agati G, Latouche G, Ben Ghazlen N, Meyer S (2008) New portable optical sensors for the assessment of winegrape phenolic maturity based on berry fluorescence. *J Food Compos Anal* 21: 650-654

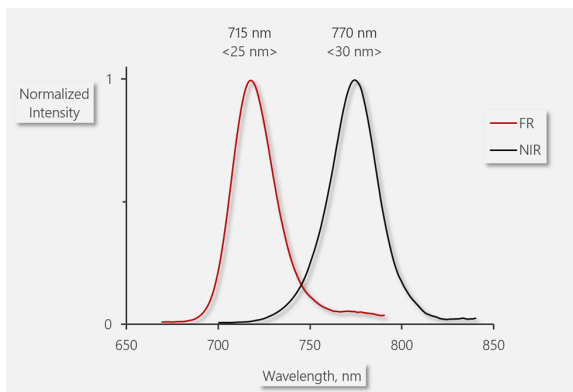
[4] Cerovic ZG, Masdoumier G, Ben Ghazlen N, Latouche G (2012) A new optical leaf-clip meter for simultaneous non-destructive assessment of leaf chlorophyll and epidermal flavonoids. *Physiol Plant* 146: 251-260

[5] Schreiber U, Schliwa U, Bilger W (1986) Continuous recording of photochemical and non-photochemical chlorophyll fluorescence quenching with a new type of modulation fluorometer. *Photosynth Res* 10: 51-62

LED Spectra

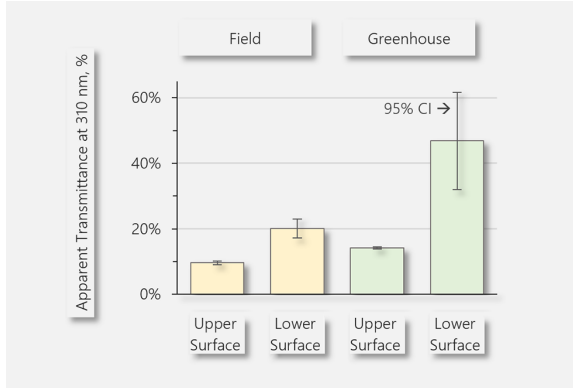


Normalized LED emission spectra of the emitter detector head of the LEAF-STATE-ANALYZER-2050. Peak positions and full width at half maximum (in brackets) are given in nm.

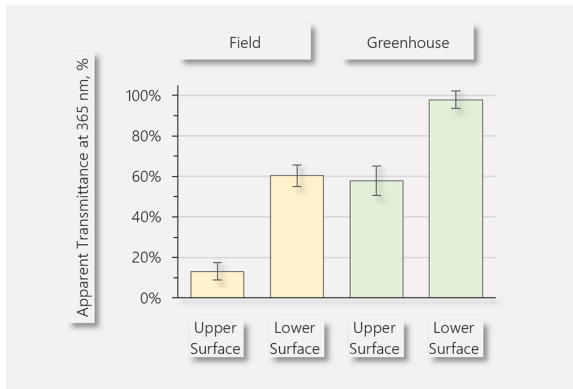


Normalized LED emission spectra of the FR, NIR emitter head of the LEAF-STATE-ANALYZER-2050. Peak positions and full width at half maximum (in brackets) are given in nm.

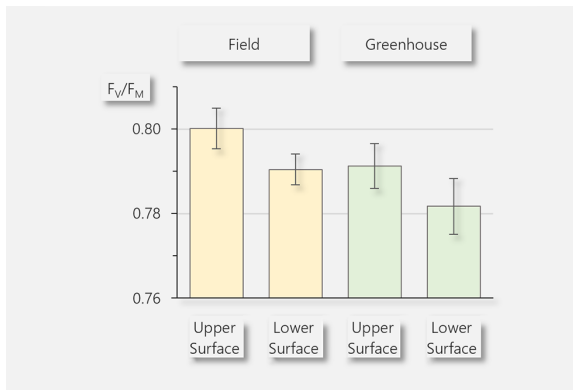
Application



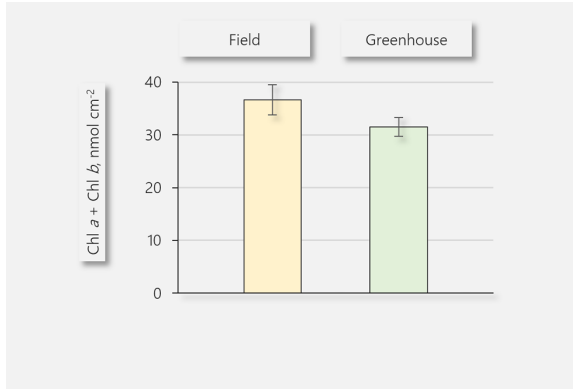
UV-B screening (Apparent Transmittance at 310 nm). Four-week-old bean seedlings (*Phaseolus vulgaris* cv. Saxa) were grown either in the field or in a greenhouse, as indicated in the figure. The visible light intensity in the greenhouse was about one third of the field intensity, and UV radiation was virtually absent. Upper and lower leaf sides were investigated (see x-axis labels). Mean values of four plants per treatment are shown (error bars show 95% confidence intervals). UV-B screening was most efficient (10%) on the upper side of field-grown leaves.



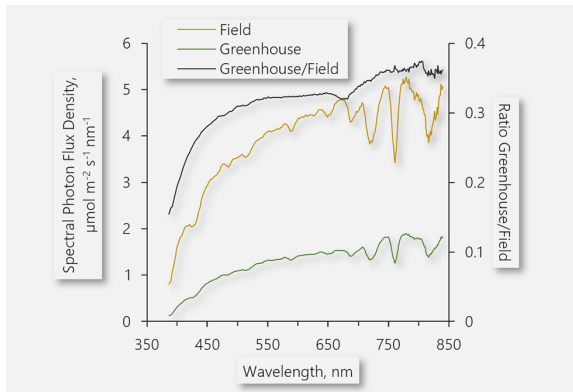
UV-A screening (Apparent Transmittance at 365 nm). UV-A screening was most efficient (10%) on the upper side of field-grown leaves but it was virtually absent on the lower side of greenhouse-grown leaves. (Turn back for experimental information.)



Maximum photochemical quantum yield of photosystem II, F_v/F_M . The largest F_v/F_M was measured on the upper side of field-grown leaves, the smallest F_v/F_M had the lower side of greenhouse-grown leaves. The data is in agreement with Wientjes et al. (2013) J Phys Chem B 117: 11200–11208 who have ascribed high F_v/F_M to acclimation to high light intensities of the light harvesting antenna of photosystem II. (Turn back for experimental information.)



Total chlorophyll concentration (Chl *a* + Chl *b*) is higher in field-grown leaves compared to greenhouse-grown leaves. (Turn back for experimental information.)



Light spectra measured at noon in the greenhouse (green line) and in the field (dark yellow). The ratio spectrum "Greenhouse/Field" (black line) dropped from roughly 0.3 at 500 nm to about 0.15 at 400 nm. This drop is due absorption of blue light by the greenhouse, which becomes prominent in the UV range. Spectra were recorded with a Miniature Spectrometer MINI-SPEC/MP (see MINI-PAM-II, Accessories).

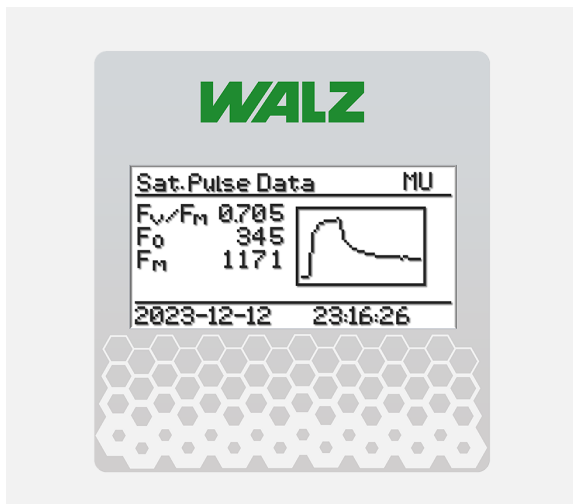
LSA-2050 Software

General Features and Graphical User Interface

The LSA-2050 software runs as firmware on the processor of the LEAF-STATE-ANALYZER LSA-2050. All data acquisition and instrument settings are carried out using the keypad on the instrument. Acoustic signals indicate start and end of the measurement. Special Windows software converts the LSA-2050 data into an Excel file. The Excel file displays all key results in a clear manner. Without exception, all individual values, from which the results are derived, are easily accessible.



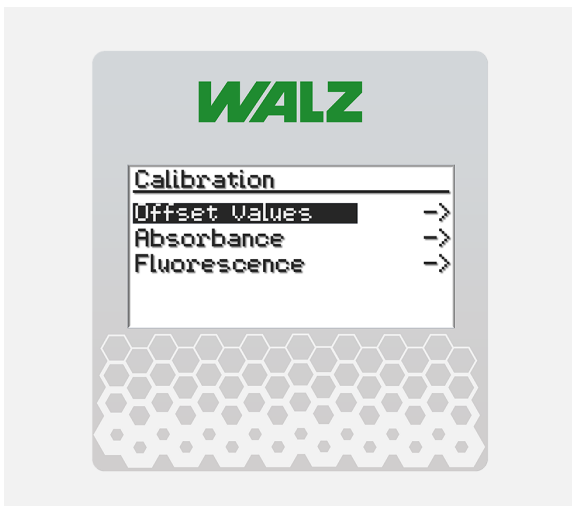
LSA-2050 Overview.
All measured values are clearly presented in numerical and graphical form.



Sat. Pulse Data.
The F₀, F_m, and F_v/F_m data plus the fluorescence transient induced by the saturation pulse are provided.



Main Menu.
The Main Menu leads to all settings and functions of the LSA-2050.



Calibration.
The Calibration menu gives access to the individual calibration procedures.

Accessory for LEAF-STATE-ANALYZER LSA-2050

Darkening Bags LSA-2050/DB

The accessory is designed for darkening of leaves in the field. Dark-acclimation is prerequisite to measure the maximum photosystem II quantum yield, F_v/F_m . The bags consist of light-tight material. Chlorophyll concentration can be determined through a central hole. The bags are available in three sizes. For details see Specifications.



Specifications for LSA-2050

Specifications are subject to change without notice.

LEAF-STATE-ANALYZER LSA-2050

General Design

Housing: Battery-powered handheld device consisting of a control unit and a sample clip, both made of painted polyamide 12 (PA 12). The control unit is equipped with a holder for four AAA-type batteries and a USB-C connector. Two metal flat springs press the clip jaws together. The lower clip jaw is removable.

Display: Backlit transfective B/W LCD display, 48 x 27 mm, 128 x 64 pixel

Control: Six control keys plus a separate START key to start a measurement

Data memory: Flash memory, 8 MB, providing memory for more than 30,000 data sets

Data transfer: USB-C port

Power supply: 4 AAA (Micro) rechargeable batteries (eneloop 1.2 V/2 Ah); 4 spare batteries, automatic power/off, battery charger (100 to 240 V AC, 50-60 Hz) for 4 batteries

Operating temperature: -5 to +45 °C, non-condensing

Dimensions: maximum 26.5 cm x 7.0 cm x 3.5 cm (L x W x H)

Weight: 240 g (without batteries)

Measuring Modules

Viewing area: Disk with 10 mm diameter

Upper clip jaw: Five LEDs are circularly arranged around a PIN photodiode, which is shielded from LED emission by a long-pass filter. A quartz glass disk closes the LED/photodiode compartment. Measuring light consists of 10 μs pulses given at 15 Hz except for F_M determinations (100 Hz). Typical maximum emission wavelength, full width at half maximum (FWHM), and integrated intensity at 15 Hz are: UV-B, 310 nm, 15 nm, $0.1 \mu\text{mol m}^{-2} \text{s}^{-1}$ (0.05 W m^{-2}). UV-A, 365 nm, 12 nm, $0.3 \mu\text{mol m}^{-2} \text{s}^{-1}$ (0.1 W m^{-2}). Blue, 450 nm, 14 nm, $0.1 \mu\text{mol m}^{-2} \text{s}^{-1}$. Green, 530 nm, 27 nm, $0.1 \mu\text{mol m}^{-2} \text{s}^{-1}$. Red, 630 nm, 24 nm, $0.1 \mu\text{mol m}^{-2} \text{s}^{-1}$. The UV LEDs are only activated in the presence of a fluorescing sample

Lower clip jaw: A far red LED (peak wavelength 715 nm, FWHM 25 nm) and a near infrared LED (peak wavelength 770 nm, FWHM 30 nm) are positioned in the center of the viewing area. The LEDs are covered by a light-diffusing disk and a quartz disk

Geospatial Data: A GPS receiver, plus accelerometer, gyro- and magneto-scope sensors add geospatial information to each measurement, including the angle at which sunlight impinges on the leaf

Battery Charger

Design: Four position intelligent charger for AA or AAA Nickel Metal Hydride (NiMH) or Nickel Cadmium (NiCd) batteries

Carrying Case LSA-2050/T

Design: Padded plastic case with handle

Dimensions: 36.0 cm x 30.5 cm x 8.0 cm (L x W x H)

Weight: 920 g

Accessory

Darkening Bags LSA-2050/DB

General Design: Set of three small, three medium and three large light-tight bags for dark acclimation of leaves of different sizes made of aluminum foil, colored on the outside. Each bag has a 2 cm diameter central hole for non-invasive determination of chlorophyll concentration with the LSA-2050. During dark acclimation, both sides of the hole are covered by metallized PET plastic flaps. The flaps magnetically attract each other which ensures that both lie tightly on the surface of the bag. The flaps are flexibly attached to the darkening bag at one end. The other, loose end is folded slightly outwards so that the sample clip of the LSA-2050 can be guided to the hole by folding open the flaps

Dimensions: 100 mm x 70 mm, 150 mm x 100 mm, 180 mm x 120 mm (small, medium, and large size, respectively)

Weight: 3 g, 4 g, 5 g (small, medium, and large size, respectively)

Scientific Publications using Walz Devices

Source: Google Scholar.

Keywords: (Walz OR Waltz) Effeltrich.

Date: February 7, 2024

= 11227

Year

Publications for LSA-2050

Not yet available

Per Year

Downloads for LEAF-STATE-ANALYZER LSA-2050

Manual & Documentation

Instruction manual for LEAF-STATE-ANALYZER LSA-2050
PDF-File (2.1 MB)